



Armed Forces College of Medicine AFCM



The functional structure of the respiratory system

**Mona Gamal El Din Al
Anan**

INTENDED LEARNING OBJECTIVES (ILOs)



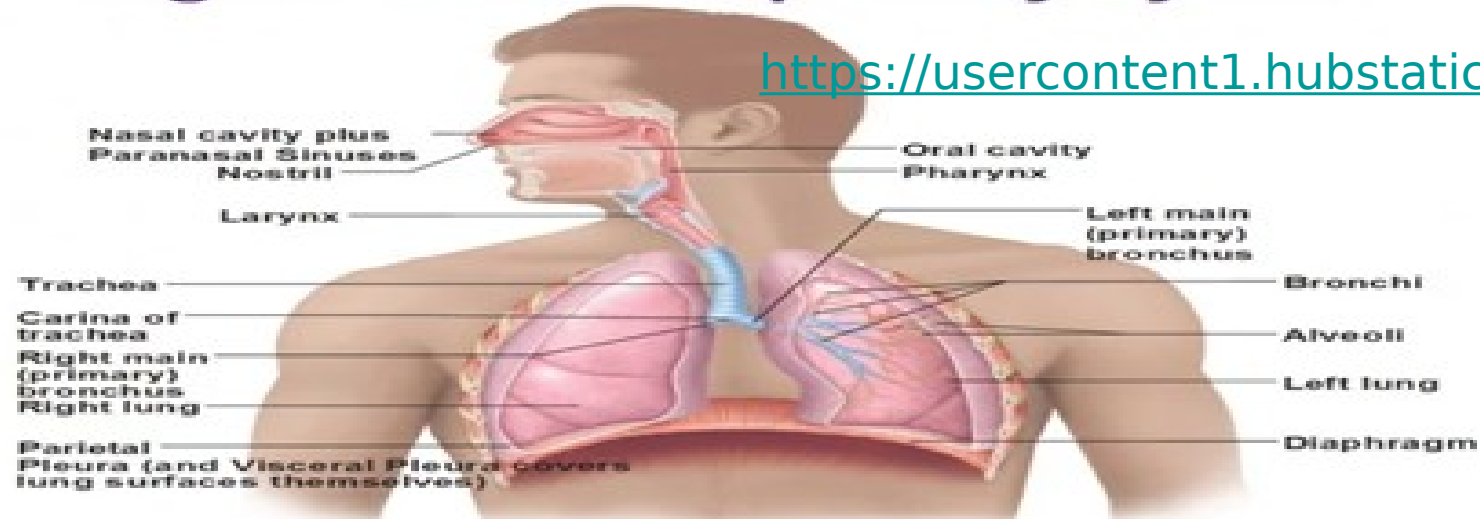
By the end of this lecture the student will be able to:

1. List the primary function of the respiratory system
2. Discuss the events “stages” of respiration
3. Describe the functional structure of the respiratory system
4. List the types of respiration
5. List the non-respiratory functions of the lungs
6. Describe the respiratory protective mechanisms

RESPIRATION



Organs of the Respiratory System



Respiration “*The processes involved in the supply of the tissues with O_2 as well as the elimination of CO_2* ”

The exchange of gases between the atmosphere, lungs,
blood, and tissues

RESPIRATION



Respiration

includes two processes

External Respiration

**Refers to
the uptake of O_2
and
removal of CO_2
from the body as a whole**

Internal Respiration

Refers to
the utilization of O_2 and production
of CO_2 by cells and
the gaseous exchanges
between
the cells and their fluid medium



The respiratory system
has

Respiratory
functions

Non-
respiratory
functions

Events of Respiration



Events of Respiration

1- External respiration (pulmonary respiration)

“uptake of O_2 and excretion of CO_2 in the lungs”

2- Transport of respiratory gases

“transport of O_2 & CO_2 “via the bloodstream”.. O_2 from the lungs to the tissues & CO_2 from the tissues to the lungs”

3- Internal respiration

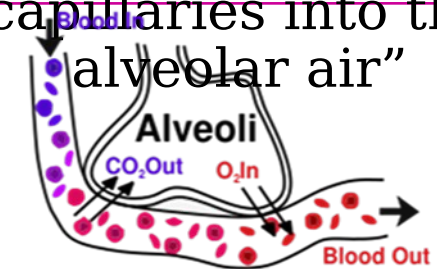
“in the tissues” gas exchange between the tissue cells and their fluid medium & the utilization of O_2 and production of CO_2 by cells”

1 a- Pulmonary ventilation

“breathing” Inhalation and exhalation

1 b- Pulmonary gas exchange

“within the lungs” diffusion of O_2 from alveolar air into pulmonary capillaries and diffusion of CO_2 from pulmonary capillaries into the alveolar air”

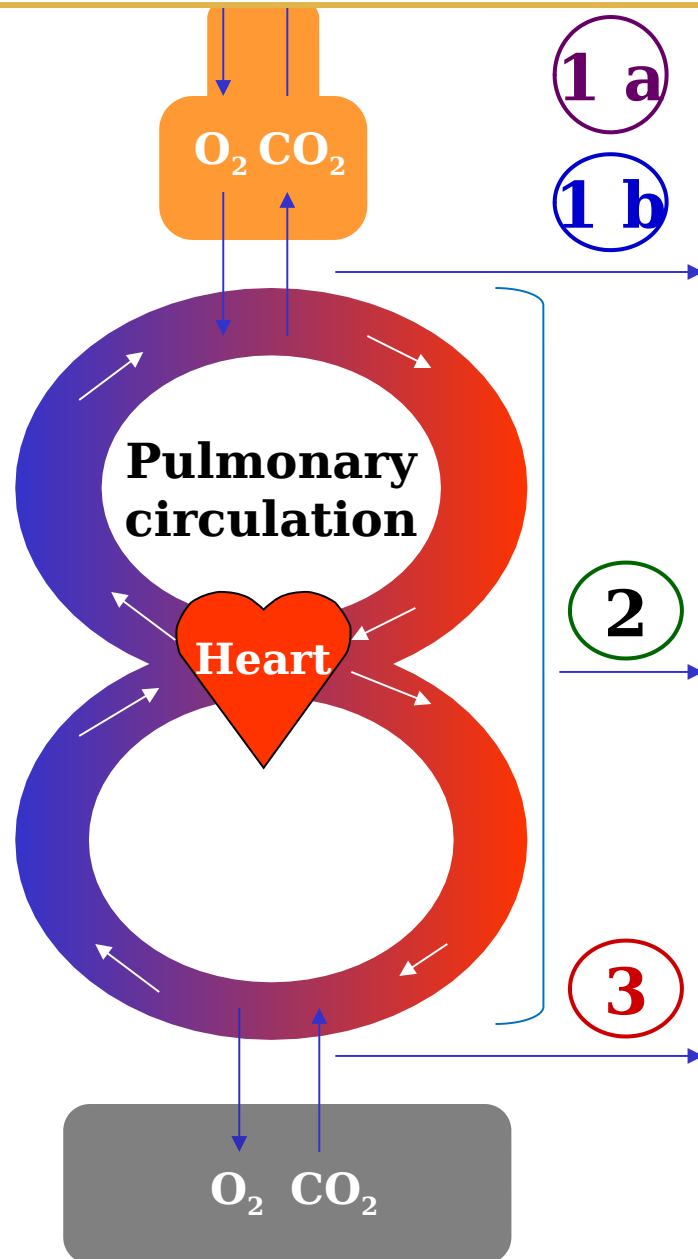


<https://upload.wikimedia.org/wikipedia/commons/8/8b/Alveoli.svg>

Events of Respiration



Alveoli



Gas exchange between the atmosphere and the alveoli

Exchange of O_2 and CO_2 between air in the alveoli and the blood

Transport of O_2 and CO_2 between the lungs and the tissues

Exchange of O_2 and CO_2 between tissue cells and their fluid medium

& ??

Tissues

Events of Respiration

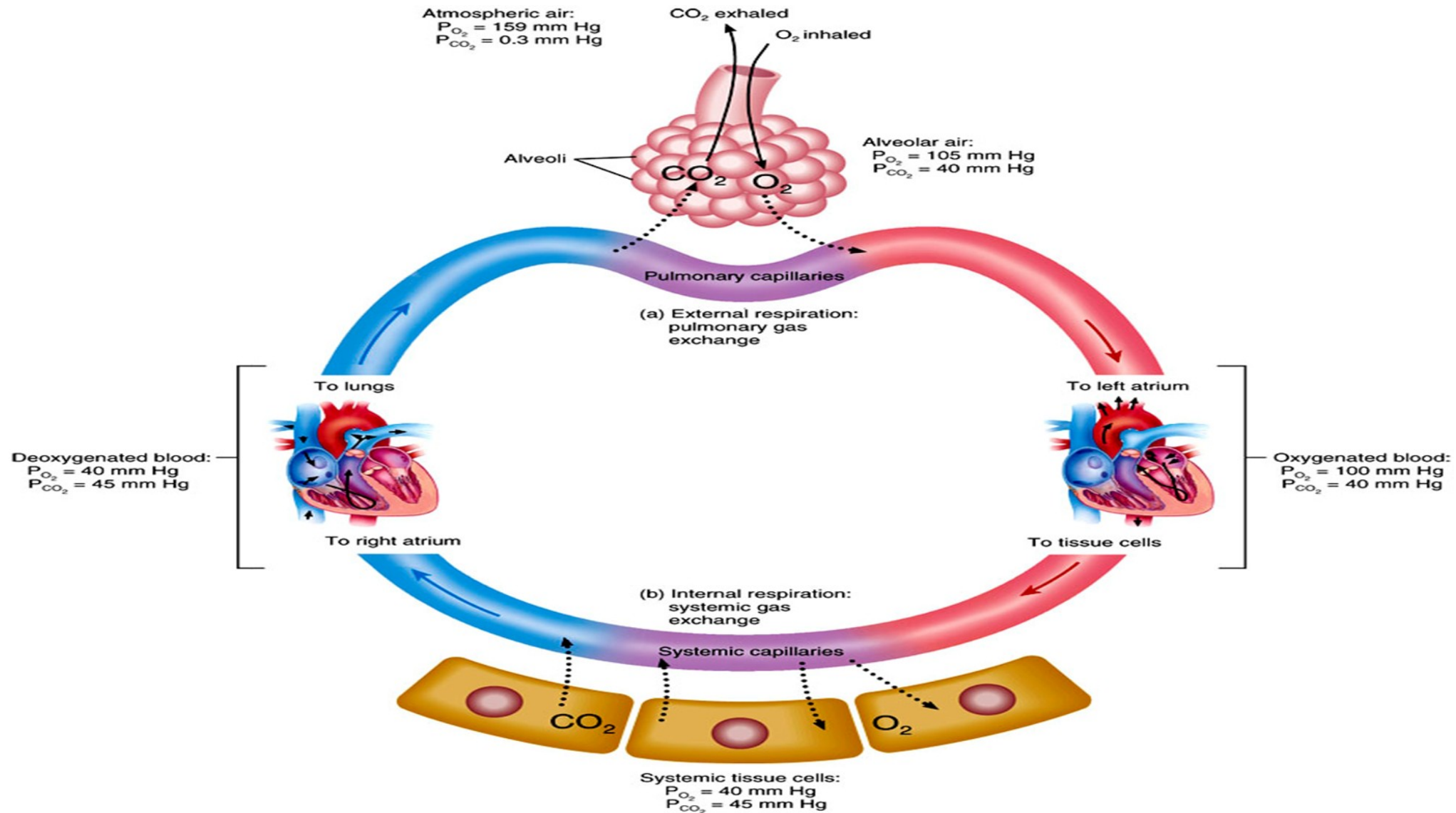


Figure 23.17 Tortora - PAP 12/e

Copyright © John Wiley and Sons, Inc. All rights reserved.

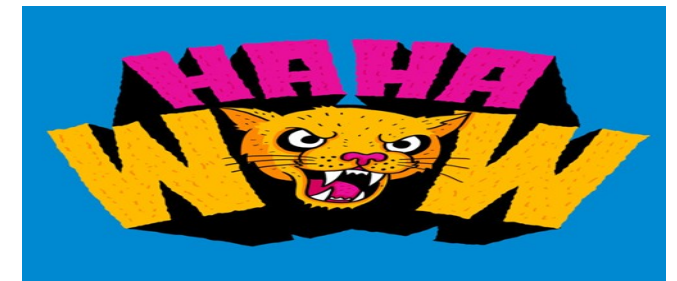
Events of Respiration



Respiratory system does not accomplish all the steps in respiration

It is involved with the ventilation and the exchange of gases between the alveoli and blood only

The rest of the respiratory processes are carried out by the circulatory system



Phases of Respiration



Phases of Respiration “two phases”

1. Inspiration

“During which air enters the lungs from atmosphere”

2. Expiration

“During which air leaves the lungs to.....”

N.B.: During normal breathing, inspiration is an active process and expiration is a passive process

The respiratory cycle is formed of *inspiration, expiration & expiratory pause*



Normal Respiratory Rate at Different Age

- Newborn : 30 to 60 /minute
- Early childhood : 20 to 40 /minute
- Late childhood : 15 to 25 /minute
- Adult : 12 to 16 /minute

Respiratory system



Structurally

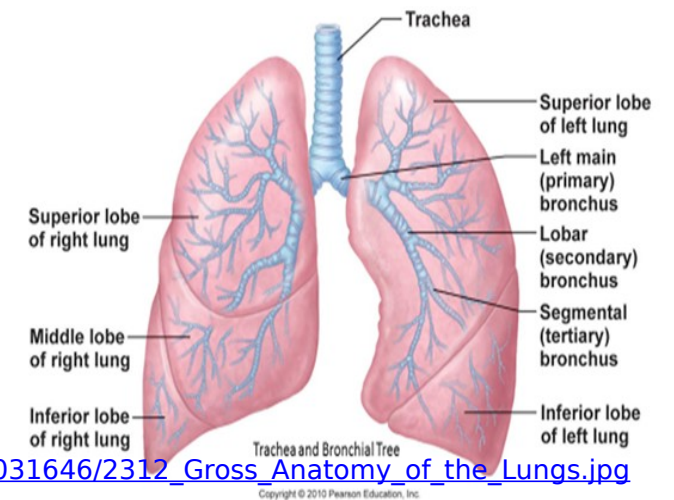
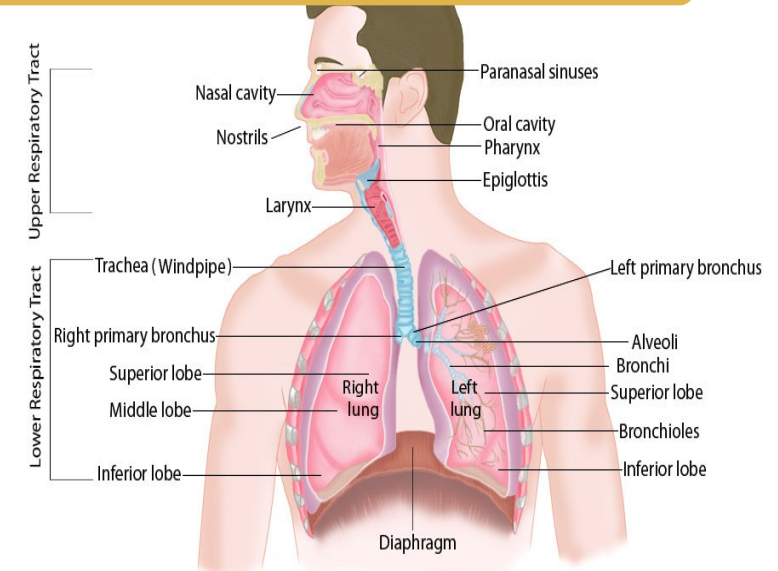
Upper
respiratory
system

Nose,
pharynx,
Larynx and
associated
structures

Lower
respiratory
system

Trachea,
bronchi and
lungs

<https://www.therespiratorysystem.com/wp-content/themes/Respiratory/images/respiratory-system-diagram.jpg>



https://s3-us-west-2.amazonaws.com/courses-images-archive-read-only/wp-content/uploads/sites/403/2015/04/21031646/2312_Gross_Anatomy_of_the_Lungs.jpg



Respiratory System

Nose, pharynx, larynx, trachea, bronchi, bronchioles and terminal bronchioles

Conducting zone
“conducts air to lungs”

Functionally

Respiratory zone
“main site of gas exchange”

Respiratory bronchioles, alveolar ducts, alveolar sacs, and alveoli

Transitional zone

Functional structures of respiratory tract

Tracheobronchial tree

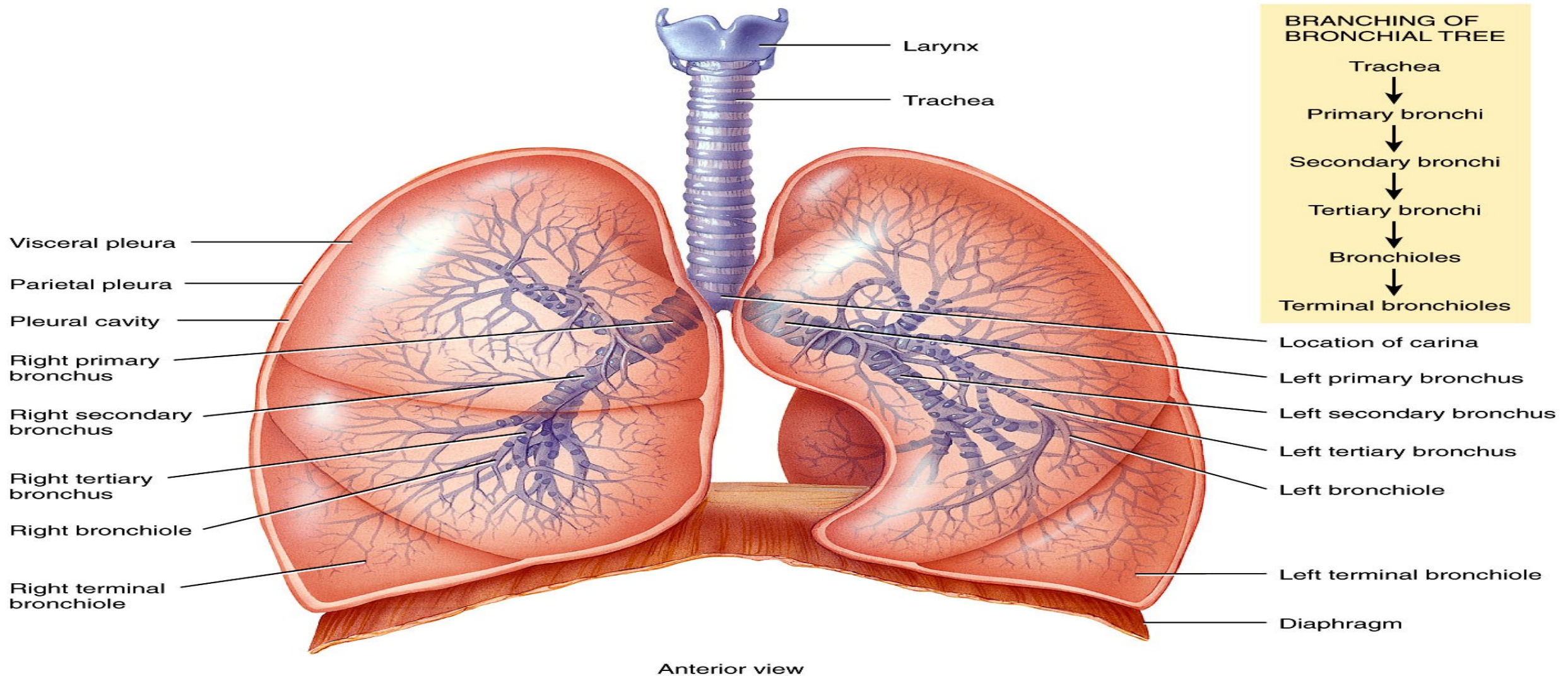
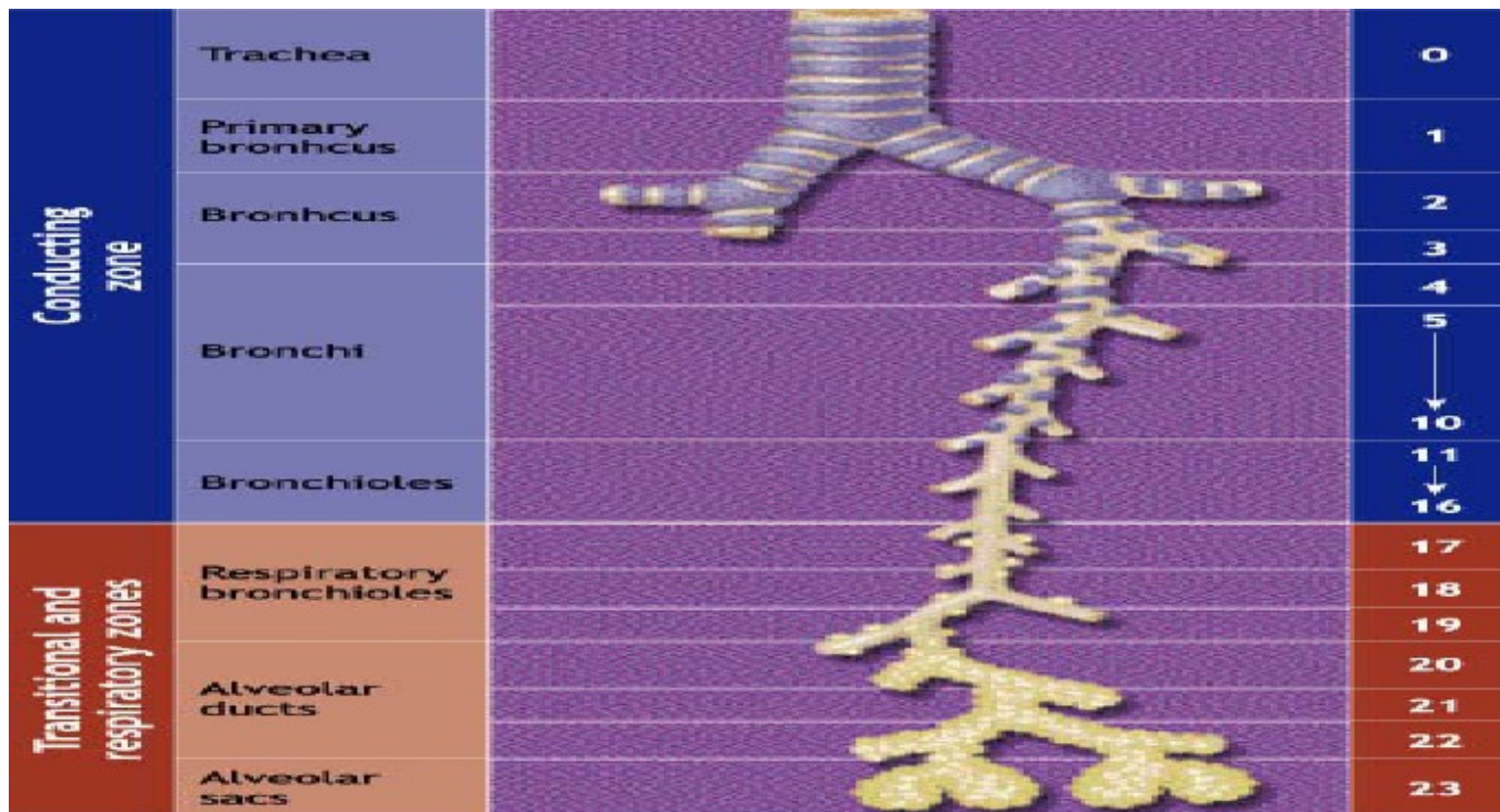
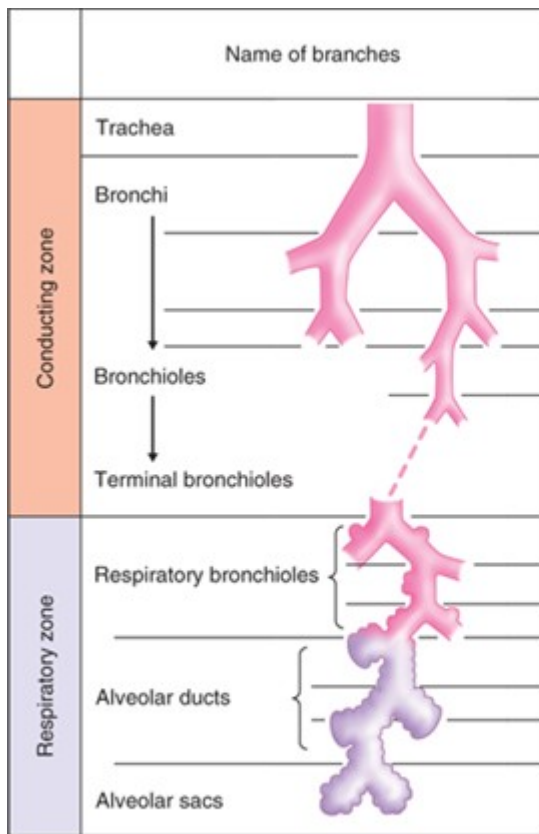


Figure 23.07 Tortora - PAP 12/e
Copyright © John Wiley and Sons, Inc. All rights reserved.

Branching of Airways



23 times

https://basicmedicalkey.com/wp-content/uploads/2016/06/m_bar_ch34_f01b.png

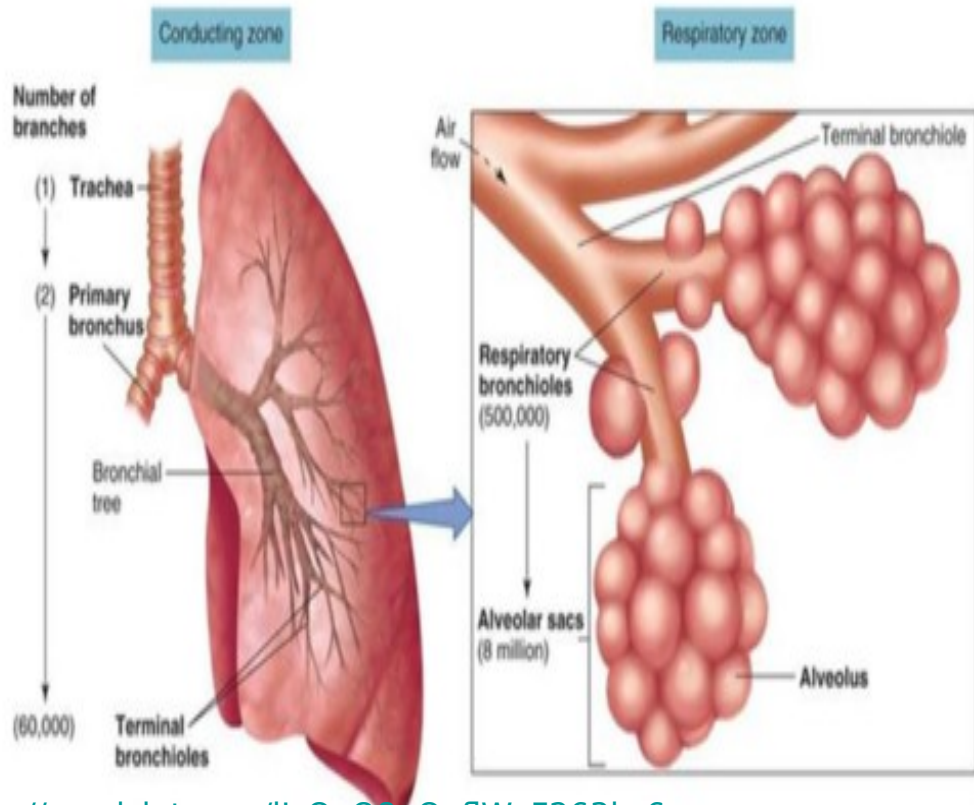
https://images.slideplayer.com/39/10957225/slides/slide_4.jpg

Importance of branching: 1-Greatly increase the total cross-sectional area
2- The velocity of air flow declines□ ??

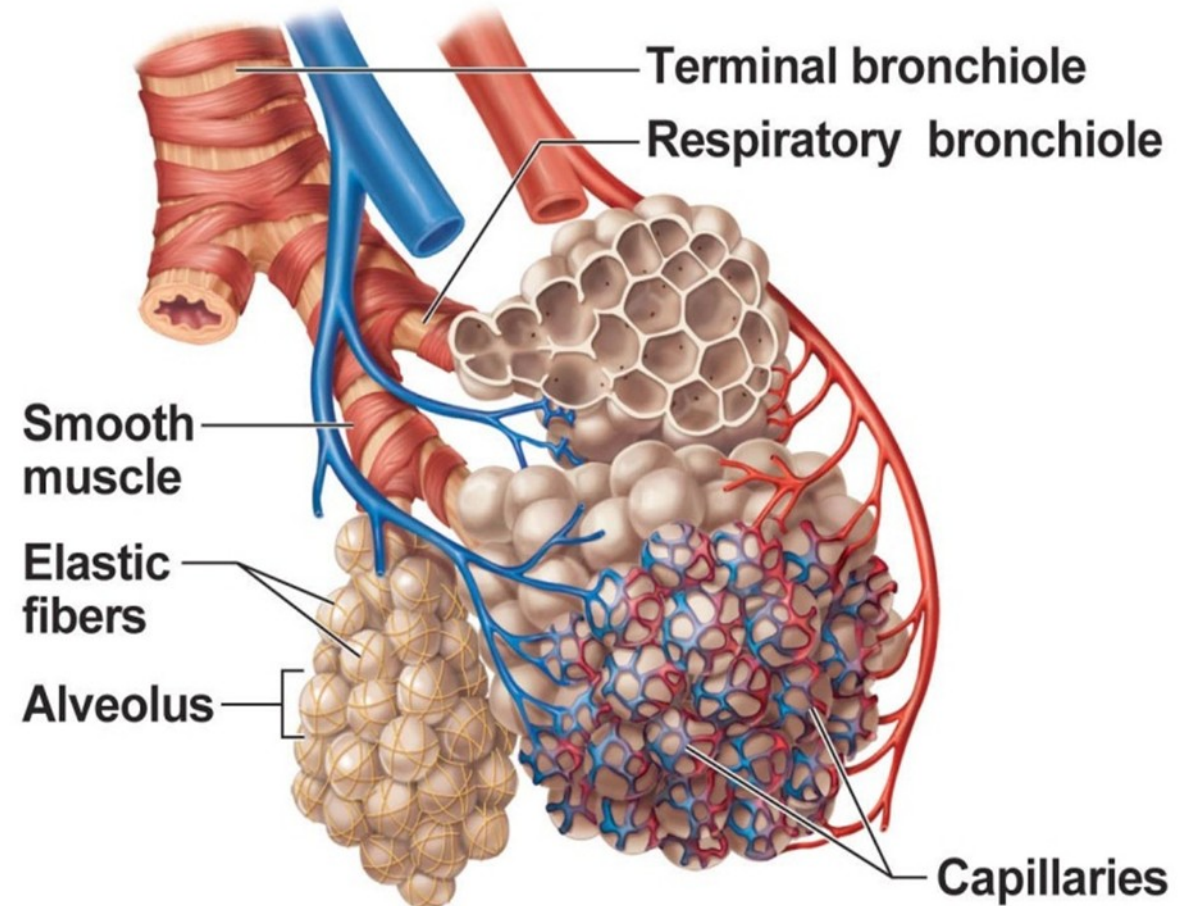
RESPIRATION



Conducting and Respiratory Zones



<https://o.quizlet.com/llsOxQ8qOyflWcF263iw6w.png>



(a) Diagrammatic view of capillary-alveoli relationships

Copyright © 2010 Pearson Education, Inc.

<https://encrypted-tbn0.gstatic.com/images?q=tbn:ANd9GcTT2Sjk6A8YygmcsWPZGzEGrJG5sC9J2Moen2o2Q2OSikno rHHB7Q>



Alveoli

**Group of
thin walled,
inflatable grape
like sacs**

**Around
300 millions
in number**

**Large
surface area
($\approx 70 \text{ m}^2$)
for gas
exchange**

**Consist of
single layer of
epithelial cells
(Type I cells) +.....**

“Components of Alveolus”

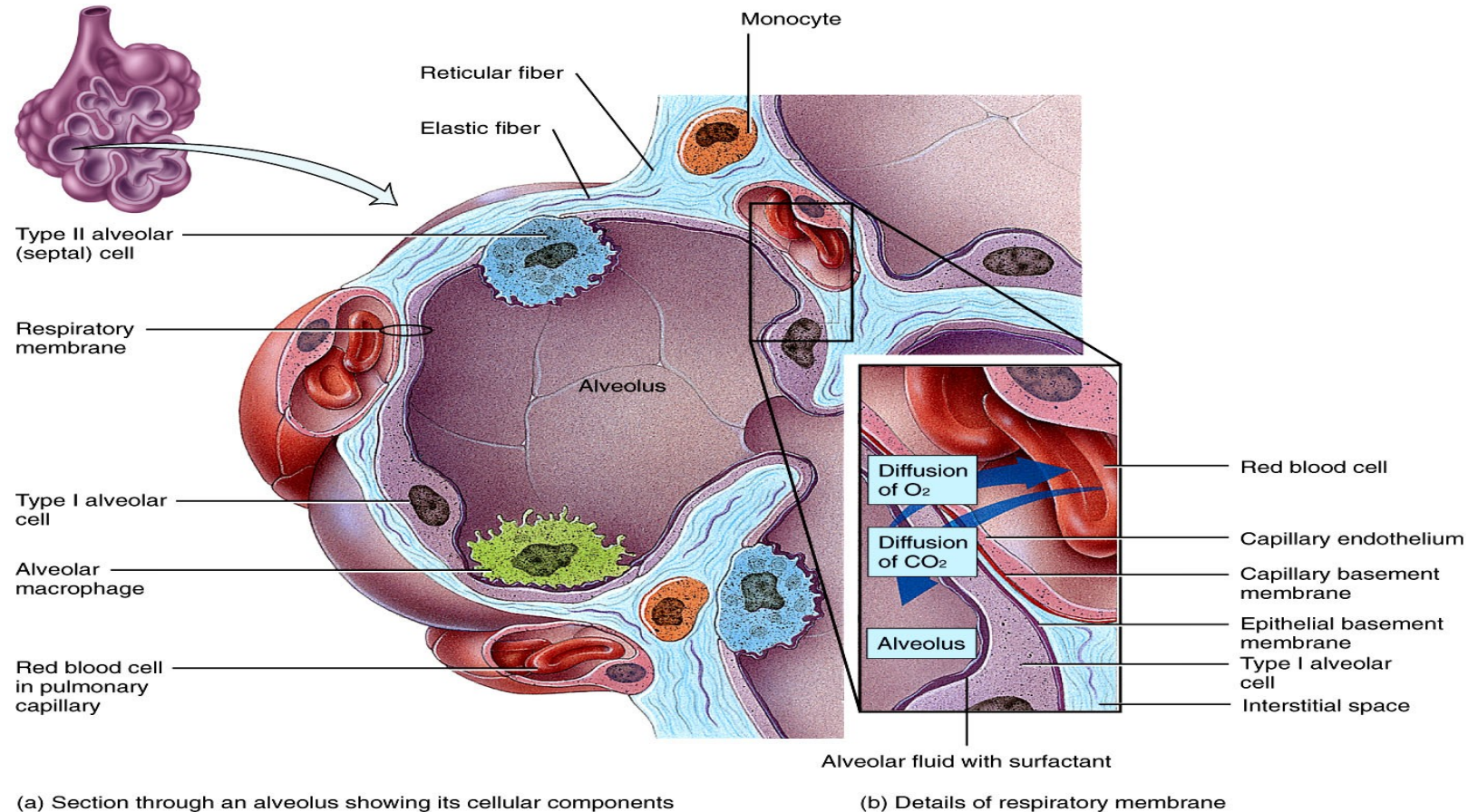
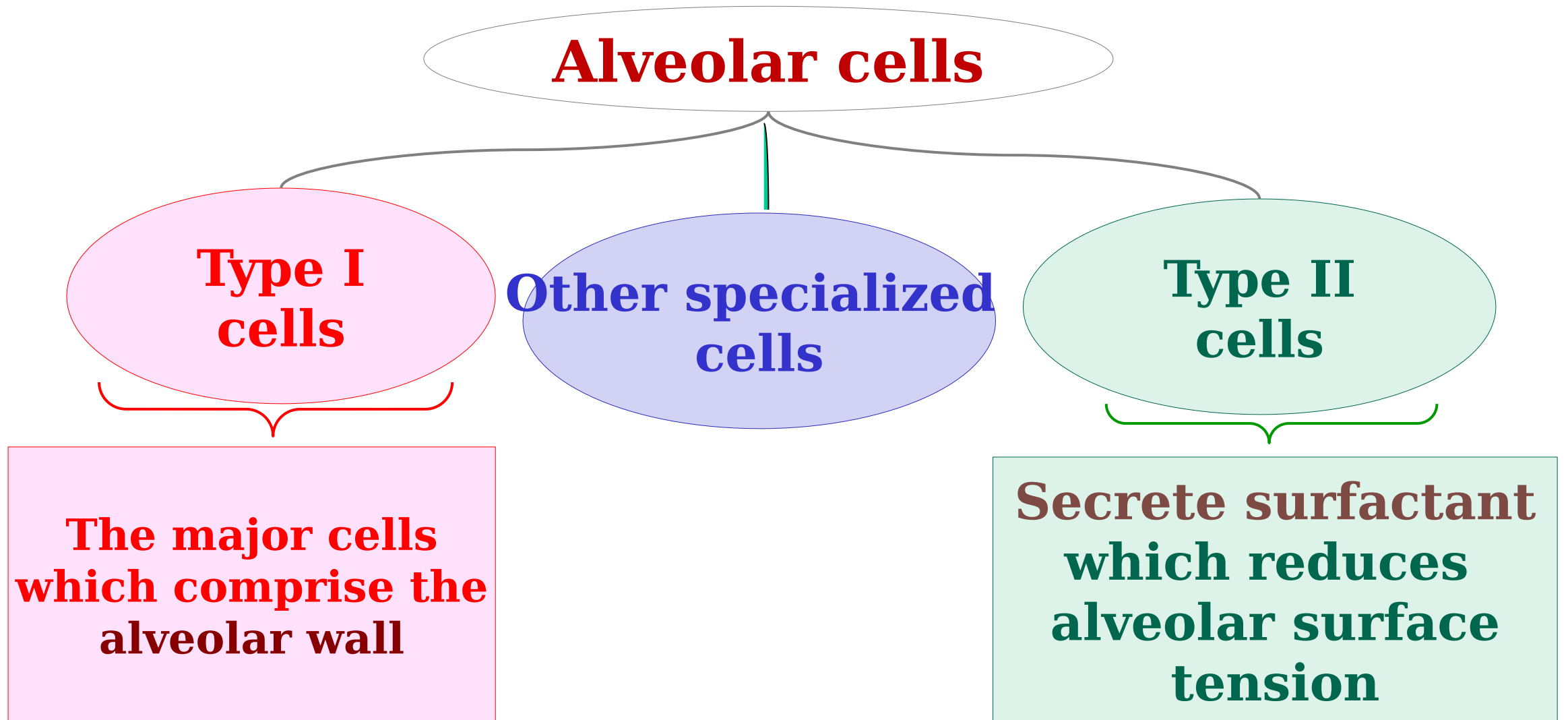


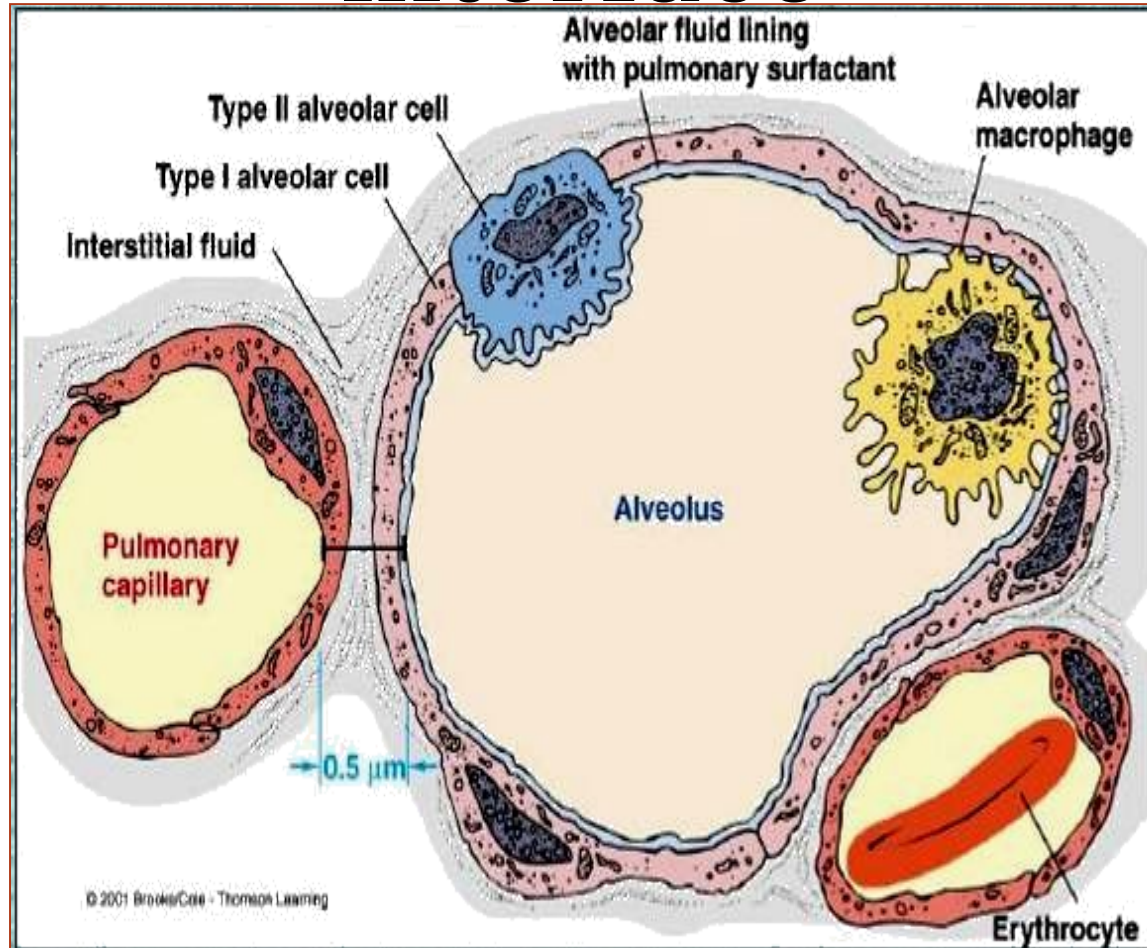
Figure 23.11ab Tortora - PAP 12/e
Copyright © John Wiley and Sons, Inc. All rights reserved.

https://encrypted-tbn0.gstatic.com/images?q=tbn:ANd9GcQZjzT5ErYj5iYf7VbLUOivVKjN2IrCL0KweT9QaghwA3dA_bv-kw

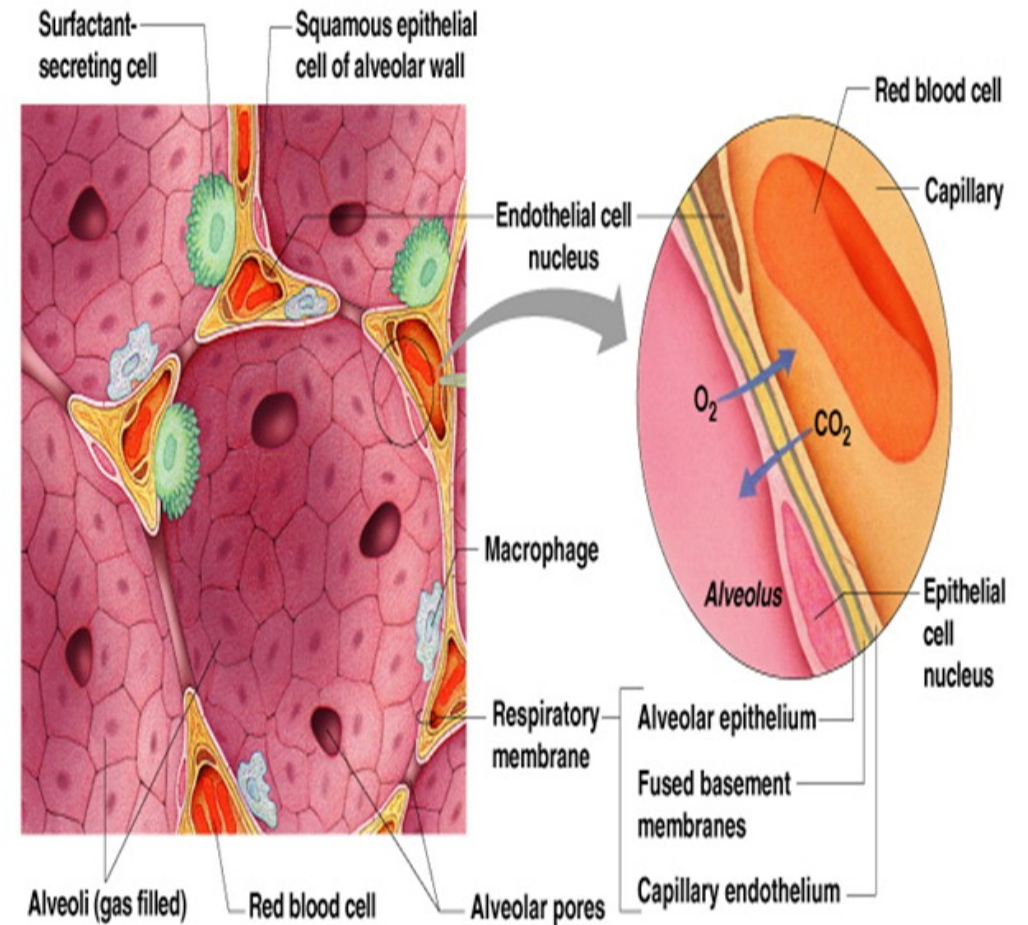


Respiratory membrane

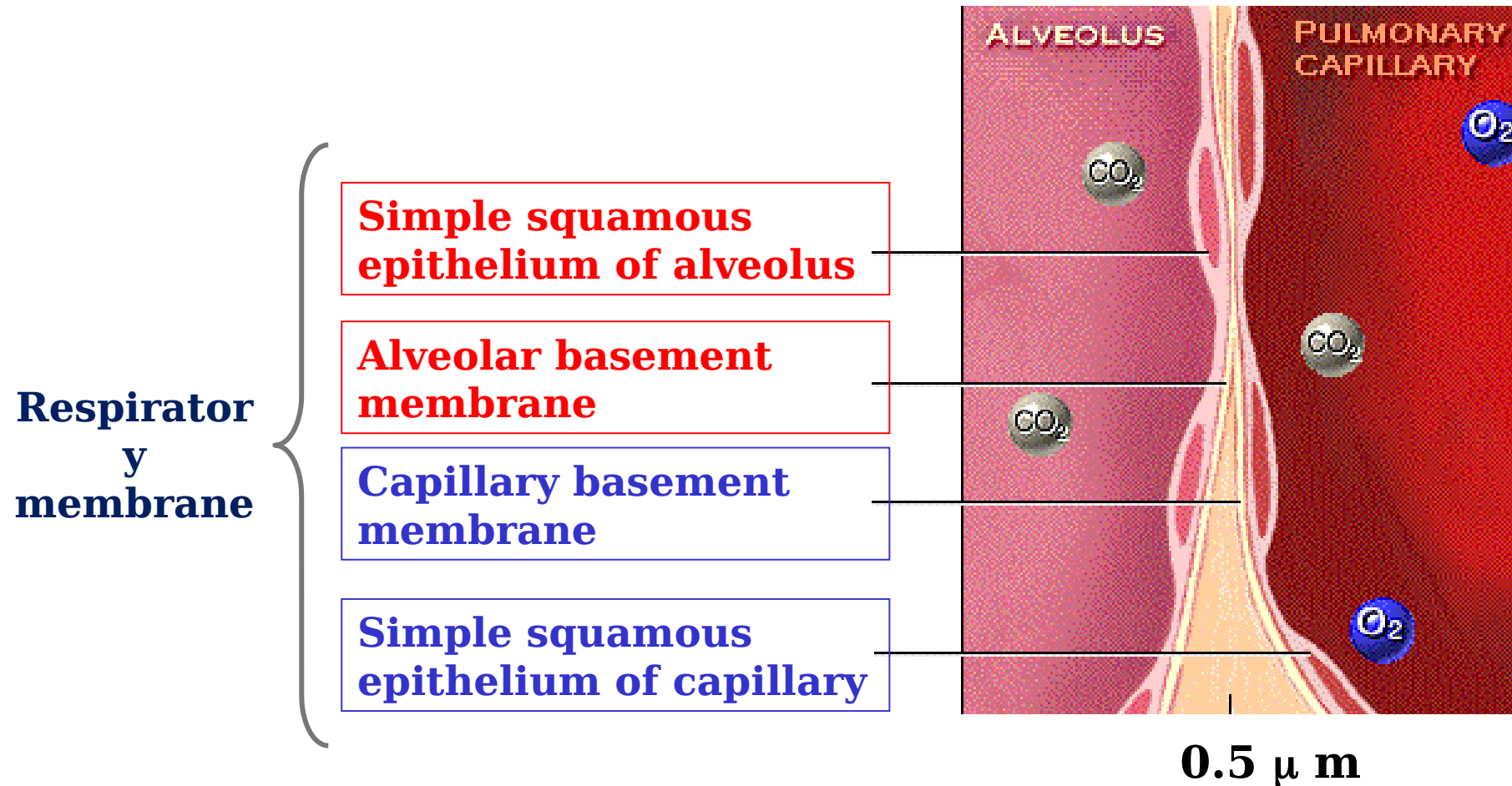
Alveolar capillary interface



Respiratory Membrane (Air-Blood Barrier)



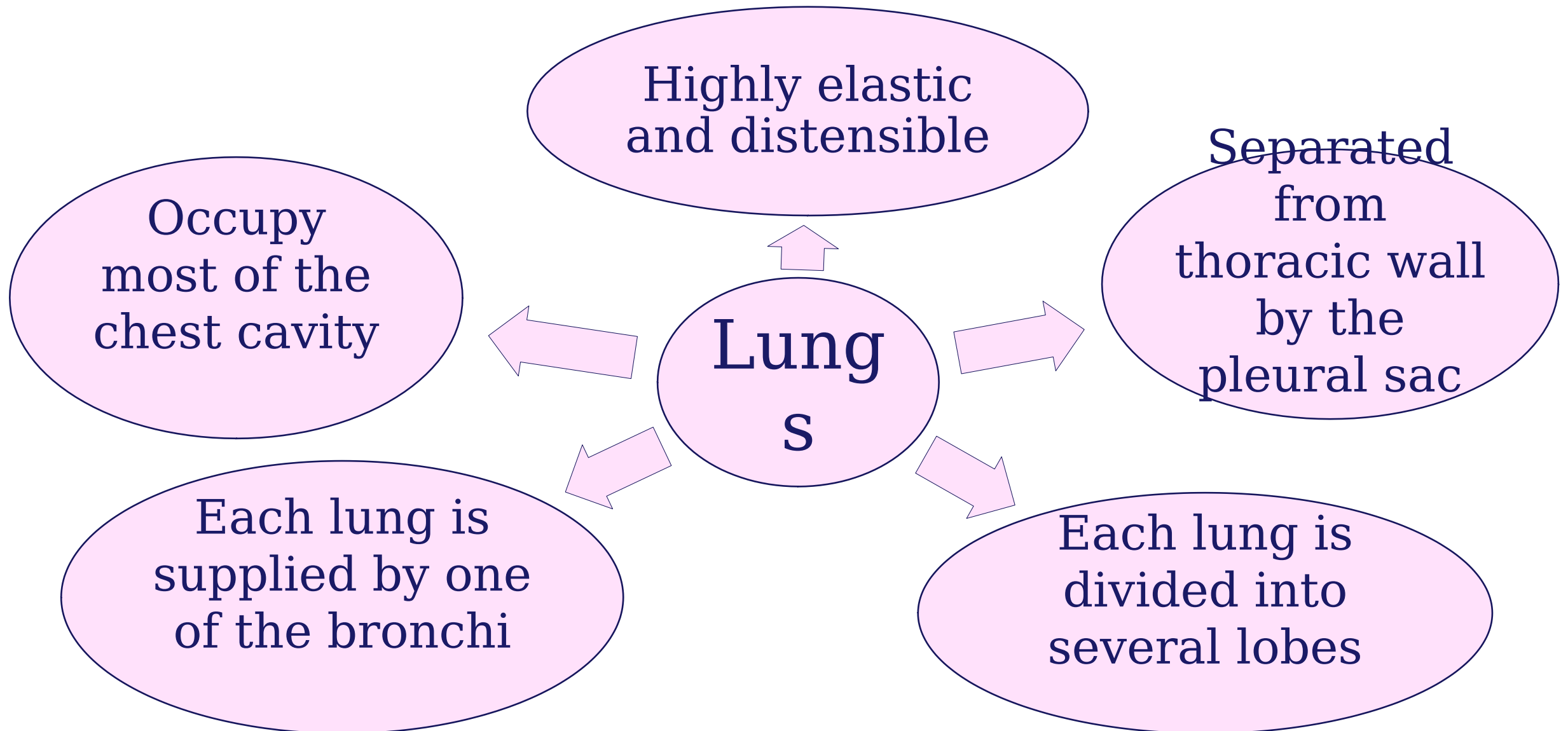
Structure of the respiratory membrane



Oxygen & carbon dioxide can easily diffuse across this membrane why??????

Very thin - only 0.5 μm thick to allow rapid diffusion of gases

Lungs



Non respiratory functions of the respiratory system



Olfaction

Maintenance “Regulation”
of
Acid-base balance

Localization or phonation

**Non-respiratory
functions**

Regulation
of
Body temperature

Prevention of dust particles

Regulation
of
Water balance

Non respiratory functions of the respiratory system



Defense mechanism

Anticoagulant function

**Warming
&
Humidification**

**Other
Non-respiratory
functions**

**Metabolic
&
Endocrinal
functions**

**Help “↑”
Venous return & lymph
(respiratory pump)**

Excretion

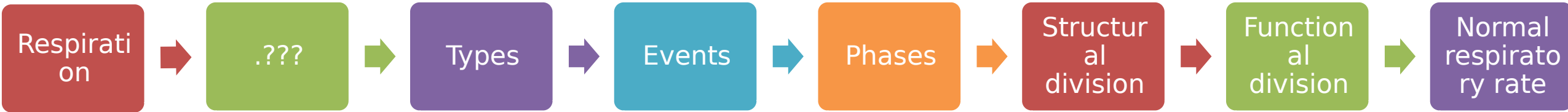
Respiratory protective reflexes



	Sneezing reflex	Cough reflex
Definition		

[illegible]

Summary



Respiratory functions

Non respiratory functions

Protective respiratory reflexes

Sneezing

Cough

Lecture Quiz



Q.1 Which of the following is false about the conducting zones of the lungs?

- a) It defends against microbes
- b) It warms and moistens the air
- c) It has a role in gas exchange

Q.2 The sequence of events involved in the exchange of O_2 and CO_2 between the lung and the environment is known as.....

- (a) internal respiration
- (b) external respiration
- (c) ventilation

Q.3 Which of the following does NOT share in gas

Lecture Quiz



Q.1 Which of the following is false about the conducting zones of the lungs?

- a) It defends against microbes
- b) It warms and moistens the air
- c) It has a role in gas exchange

Q.2 The sequence of events involved in the exchange of O_2 and CO_2 between the lung and the environment is known as.....

- (a) internal respiration
- (b) external respiration
- (c) ventilation

Q.3 Which of the following does NOT share in gas

SUGGESTED TEXTBOOKS



1. Ganong's "Review of Medical Physiology", 25th edition, section VI from page 621 to 623 & page 662
2. Guyton and Hall "Textbook of Medical Physiology", 11th edition, chapter 37, from page 478 to 482 & page 496
3. Sembulingam "Essentials of Medical Physiology", 6th edition

